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December 10, 2007

Mr. Mike Ribordy
On-Scene Coordinator
United States Environmental Protection Agency, Region V
77 West Jackson Boulevard, Fifth Floor
Chicago, Illinois 60604

Re: Allied Paper Removal Site, Dredging Evaluation and Recommendations, Revision 1
Plainwell, Allegan County, Michigan
TDD: S05-0002-0703-015
DCN: 174-2A-ABKY
WO#: 20405.012.002.0174.00

Dear Mr. Ribordy:

The United States Environmental Protection Agency (U.S. EPA) tasked the Weston Solutions, Inc., (WESTON®) Superfund Technical Assessment and Response Team (START) under Technical Direction Document (TDD) S05-0002-0703-015 to observe and evaluate the dredging methodologies and removal verification techniques currently employed in the shallow and deep water portions of the Kalamazoo River at the Allied Paper Removal Site (Site) in Plainwell, Allegan County, Michigan. On November 19, 2007, WESTON START members Ms. Sarah Meyer, Mr. Christopher Lantinga, and Mr. Richard Beach joined U.S. EPA On-Scene Coordinator Mr. Michael Ribordy, Michigan Department of Environmental Quality Project Manager Mr. Paul Bucholtz, and WESTON START member Mr. Michael Browning on site for this purpose. While on site, the evaluation team observed dredging equipment and activity, and site conditions including water depths, current velocities, and near-shore and floodplain sediment types and thicknesses.

To date, verification of sediment removal in the completed river reaches has been achieved through direct visual observation. As the dredging continues in the Spring of 2008, deeper water depths (up to approximately eight feet) will be encountered whereby direct visual confirmation of sediment removal will not provide sufficient verification. Therefore, alternatives were discussed and compiled during the meeting as potential removal and residual verification techniques.

As part of the on-site evaluation, the team also discussed alternative dredging techniques that may enhance sediment recovery, and reduce residuals and sediment loss to the water column.

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Alternative removal-monitoring, residual-verification and dredging techniques are presented below.

REMOVAL MONITORING

These monitoring techniques could be used to provide an enhanced level of assurance and documentation that dredging has occurred in a manner that can maximize removal effectiveness, and that the proposed dredge elevation has been achieved. However, these methods are not effective in verifying the presence or absence of residuals on the sediment surface.

1. **DREDGEPAK Upgrade:** As noted during the meeting, the dredging contractor is using a version of DREDGEPAK® hydrographic software that allows the dredge operator to observe the cut elevations and bucket locations in real time on a monitor located inside the excavator cab. However, it does not appear that the version of DREDGEPAK being used continually records the positional information as each bucket of sediment is removed from the river bottom. Upgrading the current version of DREDGEPAK to the newest software version would allow the dredging company to record and download the record of dredging on a daily basis for submittal to the U.S.EPA for review. Using this software would provide an enhanced level of assurance and documentation that overlapping cuts and bottom dredge elevations are achieved over the entire dredging area.
2. **Excavator Camera:** An additional level of assurance regarding dredging operations could be achieved by installing a wireless camera inside the excavator cab pointed at the cab monitor displaying the real-time DREDGEPAK output. The wireless signal would be transmitted to a receiver/monitor display at an upland office location. This would allow the oversight agencies and respective on-site representatives to view dredging activities at any time during operations. Furthermore, knowledge that the regulating agencies could potentially be observing and/or recording dredging operations at any time may provide an incentive for the excavator operator to perform dredging more carefully than without the in-cab camera. WESTON successfully utilized this method during dredging operations at the U.S. EPA Cannelton Superfund Site in Sault Sainte Marie, Michigan.

RESIDUAL VERIFICATION TECHNIQUES FOR DEEPER WATER ENVIRONMENTS

These methods could be used to verify the thickness of residuals in an area after dredging has taken place.

1. **Sediment Probe Gauge:** This probe would consist of a graduated inner rod and an outer casing connected to a bottom foot with a large surface area (**Figure 1**). When the probe



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is deployed into the water column, the probe foot would rest on the sediment surface and, due to its large surface area, minimize the pressure on any residuals there. Upon deployment, the tip of the inner rod would be level with the position of the probe foot and the foot-level elevation would be recorded (a reading of the graduated inner rod relative to the top of the outer casing). Thereafter, the inner rod would be pushed by hand through the residuals until refusal which would presumably indicate the depth of the underlying sand and gravel river bed. A second measurement would be recorded at this elevation and subtracted from the initial reading to yield the thickness of the residuals.

To determine probing locations in a completed river reach, three ferry lines could be established parallel to the shoreline within the containment area prior to removal of the silt curtain; one nearshore, one offshore, and one in between. Along each ferry line, probing could be conducted every 25 or 50 feet. At each probing location, the residual thickness and position of the probe by global positioning system (GPS) would be recorded. A map of residuals within the reach could then be produced for evaluation.

2. **Camera Probe Gauge:** This probe would consist of a waterproof camera and light source attached to a rod graduated at the end used to penetrate the sediment (**Figure 2**). The camera would be connected to the rod/depth gauge facing down towards the graduated end. As the probe is inserted into the sediment, an observer could view, in real time, the penetration depth on a monitor connected to the camera. Camera operations could also be recorded for archiving, and GPS coordinates at each probe location could be recorded with a separate unit. A map of residuals within the reach could then be produced for evaluation.

A similar method as described above for the Sediment Probe Gauge could be used to determine probing locations in a completed river reach.

A waterproof video camera, with lighting and 100 feet of cable (Aqua-Vu with Explorer Lights), is available from Aqua-Vu for approximately \$300. A package including the camera, lights, cable, and monitor that displays camera depth, water temperature, direction of view, and has video-out capability (for recording) is available from Aqua-Vu for approximately \$900.

3. **Divers:** Divers could be used to manually survey and photograph residual thicknesses along the length of a dredged reach. GPS coordinates could be recorded for each survey location and a map of residuals within the reach produced for evaluation.

A similar method as described above for the Sediment Probe Gauge could be used to determine probing locations in a completed river reach.



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4. **Sediment Profiling Imagery:** Sediment profiling imagery (SPI) is a method developed by Germano & Associates, Inc., to provide *in situ* viewing of the top eight inches of the sediment column. The camera system used is mounted on a stainless steel wedge that is pushed into the sediment column. Once the wedge is inserted up to its stop collar, the camera is used to view the sediment profile from inside the wedge through an eight-inch transparent window. Using this apparatus, the presence or absence of residuals within the top eight inches of sediment can be observed. **Figures 3 and 4** display the apparatus and a camera view, respectively.

SPI services by Germano & Associates, Inc., cost approximately \$3,200 to \$3,500 per day, which includes rental of the camera system and labor for two operators. Using this method, approximately 80-90 pictures, with GPS coordinates, can be taken per day. Additional costs include mobilization of the camera and operators, and a work platform (boat) with an A-frame must be provided. By mid-April 2008, Germano & Associates, Inc., expects to have a pole-mounted version of the camera in operation. This unit could be deployed from a jon boat.

WESTON has successfully used this product during operations at the General Electric/Housatonic River Site in Pittsfield, Massachusetts, on behalf of the U.S. EPA and U.S. Army Corps of Engineers.

5. **Sub-Bottom Profiling:** In December 2000, Blasland, Bouck & Lee, Inc. initiated a survey of the Kalamazoo River from Morrow Lake to Lake Allegan using three sub-bottom profiling techniques; a dual frequency depth sounding, a Chirp sub-bottom profiling, and ground-penetrating radio detection and ranging (RADAR). In general, the surveys did not provide useful data due to adverse site conditions, such as shallow waters, near-surface gaseous-type sediments, and changes in sediment type, compaction and lithification. Detailed information is available in *Hydrographic/Geophysical Survey, Kalamazoo River, Morrow Lake to Lake Allegan, Michigan*, Ocean Surveys Inc., Report No. 00ES056, December 12, 2000.
6. **Echo-Sounding with Sediment Core Collection:** The U.S. EPA Field Environmental Decision Support (FIELDS) group has conducted a survey of the reaches of interest in the Kalamazoo River using echo-sounding combined with sediment core collection. The echo-sounding device provides bathymetric and limited sub-bottom profile details. The FIELDS group collected sediment cores in conjunction with the echo-sounding survey to verify sediment thicknesses. A complete description of this method is available in *Standard Operating Procedures for Bathymetric and Sediment Surveys at the Kalamazoo River Superfund Site, Michigan* (U.S. EPA FIELDS, updated April 12, 2007).



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DREDGING TECHNIQUES

The following modifications to the dredging techniques currently used on site could improve the ability of the dredger to capture contaminated sediment and leave fewer residuals.

1. Bucket Design for Mechanical Dredging:

- a) The bucket of the long-reach excavator being used during the site visit had two approximately eight-inch diameter drainage holes on the back side of it to minimize collection of water during dredging. However, these holes not only allow water, but suspended fine-grained sediments to escape the bucket during extraction. Typically, contamination in the form of polychlorinated biphenyls, the contaminants of concern on site, is adhered to fine-grained, organic material. Therefore, contaminants are likely re-released into the water column along with fine-grained sediment during extraction.
- b) The bucket used on site appeared to be a 1.5 cubic yard (CY) open bucket. By increasing the bucket size, the number of overall bucket cycles required to remove the contaminated sediment is reduced; this translates to less material lost throughout the overall course of the project.
- c) The open bucket design can work well in shallow water dredging environments, however in deeper water environments, there are more limitations to effective use of this equipment. In deeper water environments, as the open bucket is filled with contaminated sediment and pulled through the water column, water passes over the open bucket face removing unsecured sediment in the process. By containerizing the contaminated sediment at the point of collection, use of a closed bucket can minimize the loss of contaminated sediment during bucket retraction through the water column. The photo in **Figure 5** shows an example of a long-reach excavator with a 2.5-CY closed bucket being used for dredging.

2. **Multi-Lift Cutting Approach for Mechanical Dredging:** Although dredging of contaminated sediment was not observed during the site visit, use of proper mechanical dredging techniques was discussed as a way to minimize sediment slough and accumulation of residuals. As an example, if a required sediment cut exceeds the depth of the excavator bucket depth by more than half, a multi-lift cutting approach is recommended. A multi-lift cutting approach requires that the dredge operator excavate one discrete section of a reach at a time; this section is usually defined by the maximum reach of the excavator arm. During the first lift of that discrete section, the operator removes one bucket depth of sediment. The operator then makes sequential passes over the discrete section, removing one bucket depth of sediment at a time, until the desired dredge elevation is reached. Using this approach, a thick unsupported cut face that can



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slough into the open voids produced by continuous excavation is not produced at each bucket width. Sloughing will still be possible at the perimeter of the discrete section, but this approach minimizes the overall area where sloughing can occur.

In addition, if multi-lift cutting is required, it is preferred that the final lift extracts full buckets of sediment that include residuals suspended and re-deposited during previous lifts. This not only ensures that residuals produced during previous lifts are collected, but by filling the closed bucket with sediment during the final lift, there is less chance of water and fine-grained sediment escaping from the bucket during the final lift.

3. **Reach Overlap Method for Mechanical Dredging:** While the multi-lift cutting approach can minimize the amount of sloughing that occurs within a discrete section of cutting, sloughing will still be possible at the perimeter of the discrete sections, and at the perimeter of each reach of the river. To recover sloughed material that may be present between adjacent discrete sections and/or river reaches, the dredge operator should effectively overlap cutting areas and re-dredge a portion of the area already dredged. The amount of overlap can be determined by the dredge operator to ensure that sloughed material between adjacent sections/reaches is recovered.



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RECOMMENDATIONS:

WESTON START recommends implementation of a combination of the above-described removal-monitoring, residual-verification, and dredging techniques. WESTON START recommends use of the DREDGEPACK Upgrade, the Excavator Camera, the Sediment Probe Gauge, the Camera Probe Gauge, and the mechanical dredging techniques. Implementation of these inexpensive techniques can provide information valuable to the evaluation of residuals on site.

If there are any questions or comments regarding this report, please do not hesitate to contact me at 312-424-3300.

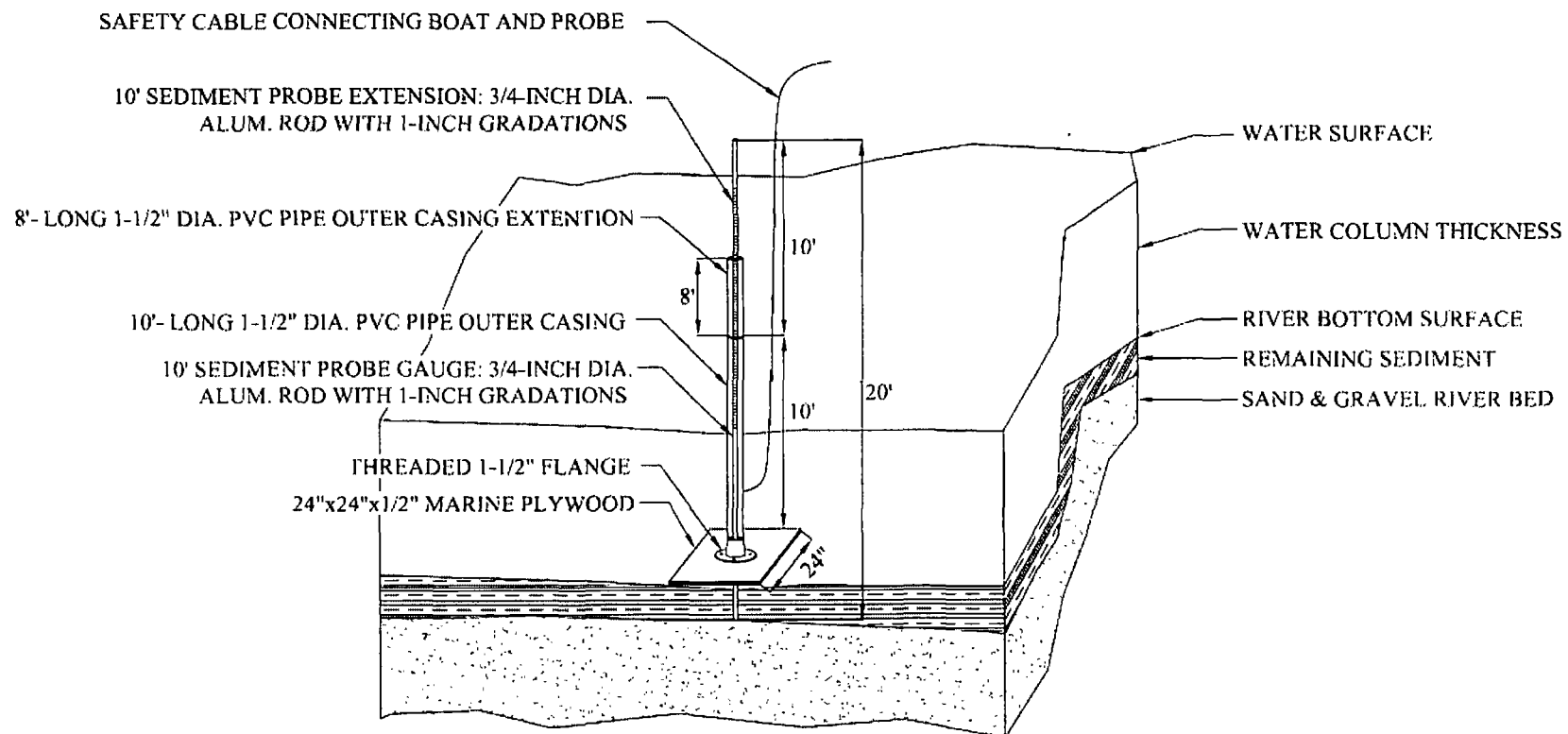
Very truly yours,
WESTON SOLUTIONS, INC.

A handwritten signature in black ink, appearing to read "Sarah Meyer", with a stylized flourish at the end.

Sarah Meyer
WESTON START Project Manager

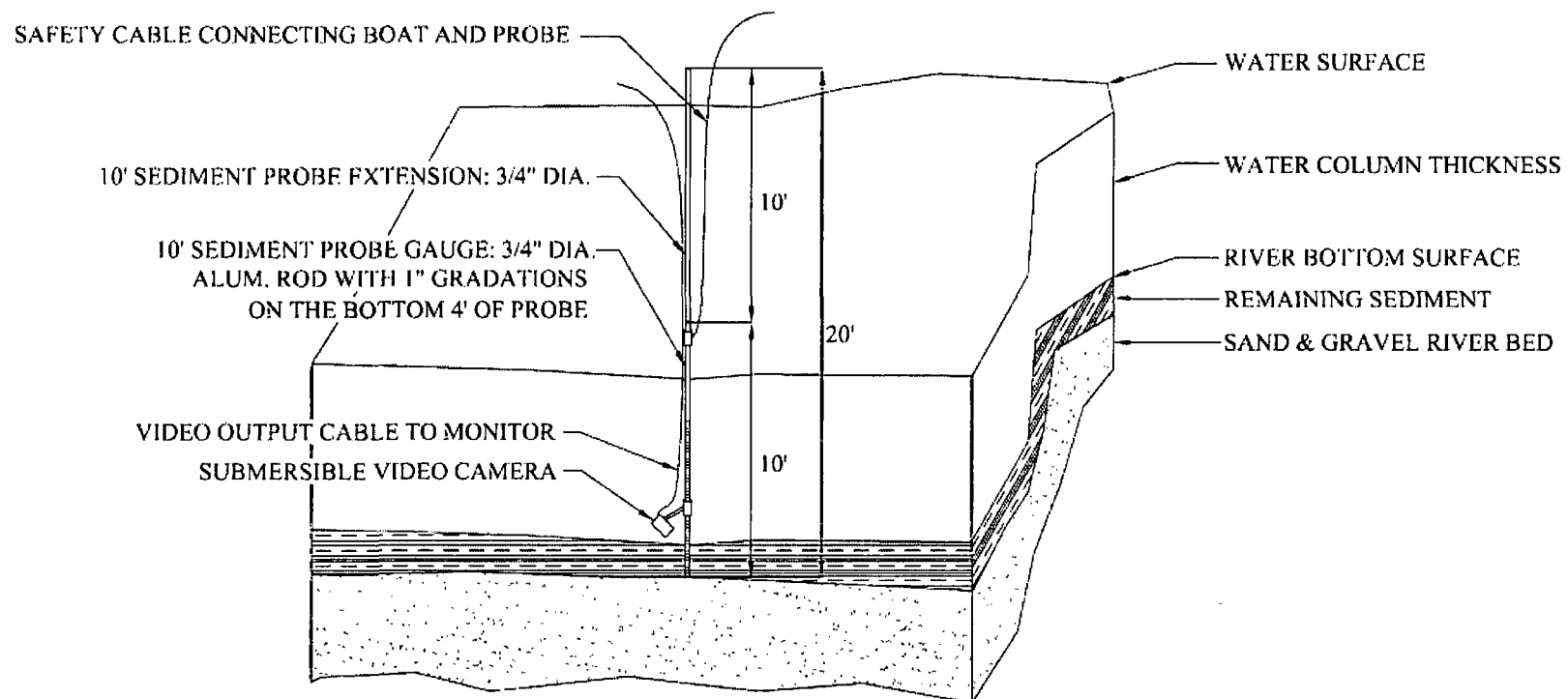
cc: Gail Stanuch, U.S. EPA Project Officer
START DCN File

FIGURES



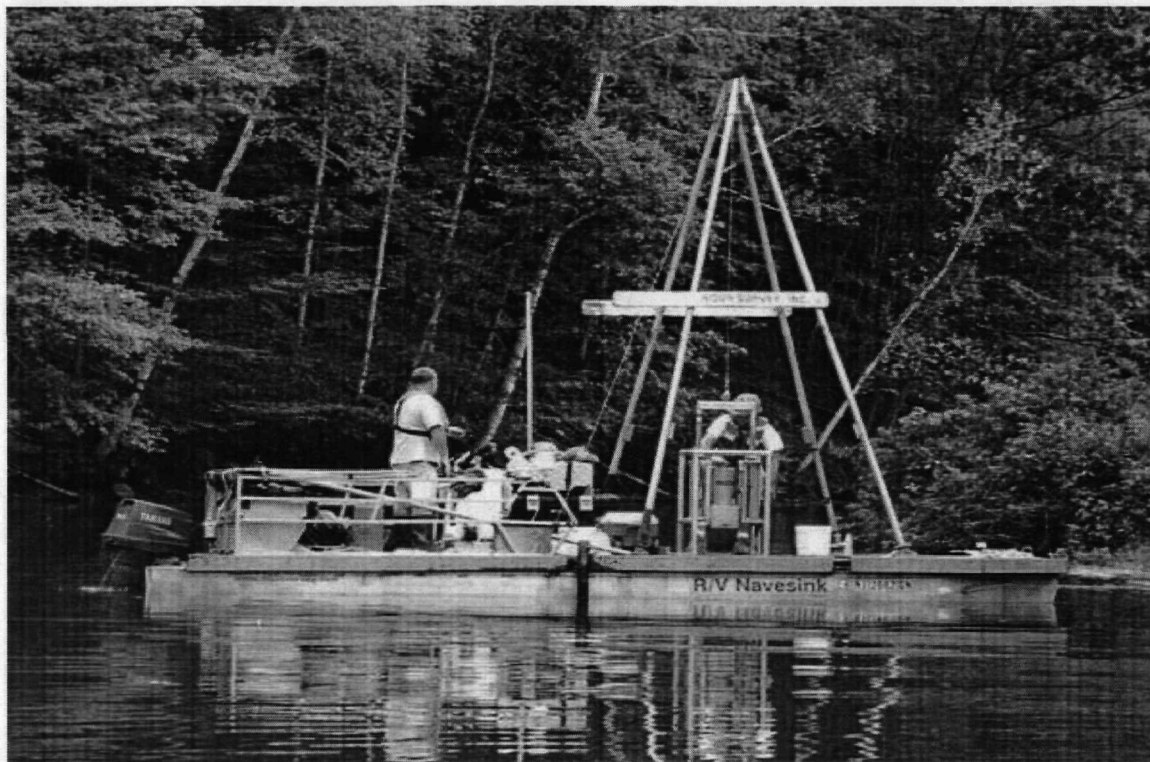
SEDIMENT PROBE GAUGE - FIGURE 1

NOT TO SCALE



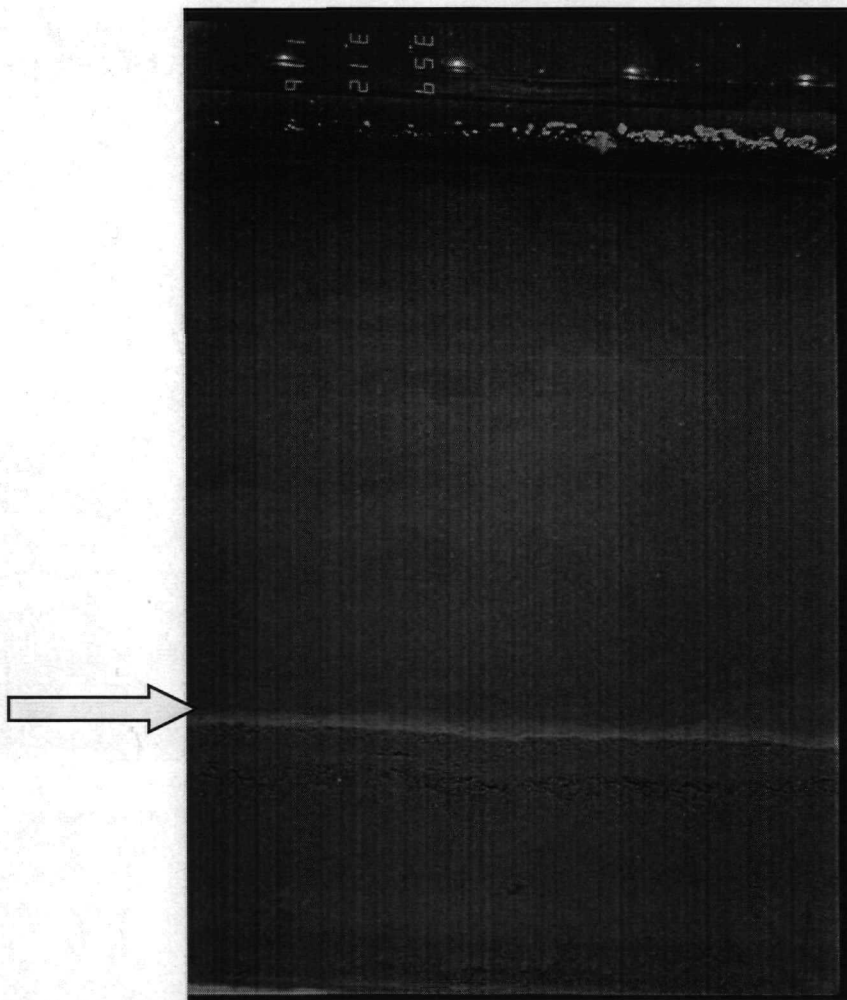
CAMERA PROBE GAUGE - FIGURE 2
NOT TO SCALE

Figure 3



Sediment profiling imagery (SPI) camera system staged on a pontoon platform prior to deployment.
Germano & Associates, Inc.

Figure 4



The eight-inch thickness of the sediment column that is viewable *in situ* with the SPI camera. The arrow points to the sediment-water interface. Flocculated sediment is visible between the arrow and the top of the photograph. Germano & Associates, Inc.

Figure 5



An example of a long-reach excavator with a 2.5-cubic yard closed bucket being used for dredging. Weston Solutions, Inc., U.S. EPA Cannelton Superfund Site, 2007.